

SCIENCE

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LIGHTHOUSE ILLUMINANTS.¹

It will be remembered that some years ago the Trinity House appointed a committee to carry out experiments at the South Foreland with a view of investigating the relative advantages of oil, gas, and electricity as lighthouse illuminants. Three experimental towers were erected, and were appropriated respectively to electricity, to Mr. Wigham's gas apparatus, and to oil, with occasional gaslights. Each lighting system was adapted to be shown in the multiform arrangement; i.e., with lights placed vertically one above the other. For gas, provision was made for showing four lights, while the electric and oil systems had three lights each. Observers were placed in huts at distances of 2,144 feet, 6,200 feet, and $2\frac{1}{2}$ miles. For observations at greater distances, advantage was taken of the services of the coast-guard between the North Foreland and Dover; of the lightmen on the "Gull," the "Goodwin," and the "Varne" lightships; of the lighthouse-keeper at the North Foreland; of pilots and masters navigating in the vicinity; and of the Elder Brethren and their officers. More than six thousand observations were taken. The conclusions arrived at were, (1) that the electric light was the most powerful under all conditions; (2) that the quadriform gas apparatus and the triform oil apparatus were of about the same power when seen through revolving lenses, the gas being "a little better" than the oil; (3) that through fixed lenses the superiority of the gaslight was unquestionable (the large size of the flames and their nearness together gave the beam a more compact appearance); (4) that the Douglass gas-burner was more efficient than the Wigham burner; (5) that for the ordinary necessities of lighthouse illumination mineral oil was the most suitable and economical illuminant, and that for salient headlands, important landfalls, and places where a very powerful light was required, electricity offered the greatest advantages.

This report did not please the advocates of gas. Memorials were poured into the Board of Trade from ship-owners, both individuals and associated bodies, asking that the experiments might be continued with duplicated gas apparatus of Wigham's pattern, this being understood to give greatly increased brilliancy. The board replied that they were informed that these experiments would cost £18,000, in addition to the £9,000 already spent, and that the state of the Mercantile Marine Fund would not allow of such an expenditure. Mr. Wigham characterized the estimate as "monstrous," and subsequently undertook to guarantee the expense should not exceed £2,000, if the existing apparatus

were used, and the services of the various employees given. The Trinity House replied that a great deal of the apparatus had been put into actual service elsewhere, and that Mr. Wigham had ignored the expense of establishing multiform oil and electric lights in comparison with his multiform gaslights.

Another objection brought against the report was that the final conclusion of the Trinity House ignoring gas was not justified by the record in the report itself. It was therefore urged upon the board that the report should be remitted to some independent scientific authority to determine if the evidence bore out the conclusions. Eventually this course was adopted, and the report sent to Sir George Stokes, president of the Royal Society, who associated with himself Lord Rayleigh and Sir William Thomson. These gentlemen have now reported to the Board of Trade at very considerable length, and, while their conclusions bear out to a large extent those arrived at by the Trinity House, yet they are distinctly more favorable to gas. They admit that it was quite natural that the splendid lights erected on the Wigham system on some parts of the Irish coast should have raised in the minds of ship-owners a feeling in their favor; but they point out that the question at issue does not relate to what has been done in the past, but that it is, "Does gas possess such advantages over oil as to outweigh the greater simplicity and economy of the latter illuminant, and should both, in the case of lights of special importance, be abandoned in favor of electricity?"

The 108-jet gas burner gives a broader flame than the 6-wick oil-burner; and with lenses of similar apertures and focal lengths, and equal velocities of rotation, the diverging beam from the gas is of longer duration. This has been taken advantage of by Mr. Wigham for the introduction of a group flashing system, by which it is sought to give each light a distinctive character. The report states, however, that with revolving lights the number of flashes in a group is somewhat uncertain; with fixed lights there is no such uncertainty. The intermittence of a revolving light is obtained very sharply and suddenly, by turning the gas completely out, and by relighting it with a burst, resulting from allowing the gas to flow for an appreciable time before the flame is applied. With oil, intermittence can only be obtained by means of shutters, as it is not feasible to turn the light out. When the Wigham burner was compared with the Douglass burner, it was found that the latter gave the more light for a given consumption of gas. The smaller size of the flame also augmented the brightness of the flash. The Douglass burner, however, requires a glass chimney, which may give

¹ From Engineering of Oct. 31.

way, particularly if the flame be turned up rapidly under a sudden fog.

The electric light apparatus far exceeded the others in the amount of light it gave out. Even in fog and haze it surpassed them; for, although the highly refrangible rays were rapidly dispersed, yet the remaining beam was not more cut down than that from gas or oil, and still maintained its superiority. This great power partly results from the smallness of the luminous area. The high condensation is obtained at the expense of the angular opening of the transmitted beam, which is less than with the taller flames of gas and oil. In practice the upper portion of the full beam must reach the horizon, as seen from the lantern of the lighthouse, while the lower portion must strike the sea at a moderate distance from its foot. It does not appear whether the electric beam employed would have fulfilled both these conditions. If it would not,—and the necessity of adjusting the carbons in certain cases to bring the full beam on to the observers suggests that it would not,—a deduction must be made from its value. Electric lights are practically reserved for revolving lights, the chief object of which is to guide the mariner from long distances. Fixed lights do not need the same far-reaching brilliancy, and it was abundantly proved that for these the gas-burners surpassed the oil-burners employed. Further, gas yields itself with special facility to conferring on a fixed light a distinctive character by means of intermittence.

All the points of difference that we have noted are clearly set forth in the reports, and little difference of opinion exists concerning them. But the advocates of gas claimed for it a special quality; namely, that of diffusing a warning glow through a fog at a distance beyond which the light could be actually seen itself. Sir George Stokes and his colleagues do not profess themselves able to decide whether the extension of distance at which warning will be conveyed by the glow from a gas or other light is such as to be of practical importance. They, however, make some general remarks on the subject, pointing out that the glow or burr is mainly produced by light which has been diffracted, and retains an approximation to its primitive direction. It is deflected from its course by an angle which is not by any means very small, and therefore it cannot matter much whether the regular light from which it originally came was concentrated by the lens within a more or less small angle. The *fog illuminating* power must depend mainly on the quantity of light sent out from the source, while the *fog penetrating* power depends on the concentration of the beam. It follows that the fog illuminating power of the electric light will be much smaller, in proportion to its power for direct penetration, than would be the case with oil, and still more with gas. Conversely, the glow from gas will extend farther beyond the limits of direct penetration of the beam than will the glow from oil, and still more than the glow from electric light. In light fog the direct light would probably be seen first; and, even if it were not, the slight extension of distance resulting from the glow would be of little value. But if the fog were comparatively thick, the ship must approach nearer to the lighthouse, where the illumination of the fog would be stronger, and the luminosity would be seen well before the actual light. This would be rendered more distinguishable from a thinning of the fog if the light was

rapidly extinguished and relighted. In the second part of the report Sir Leopold McClintock speaks of “a striking, thrilling effect, which at once caught the eye,” produced by cutting off the gas every few seconds. No opportunities, however, occurred for properly estimating the value of this effect, and it could not be taken into consideration in summing up the results of the experiments.

In reviewing the conclusions of the Trinity House committee, Sir George and his colleagues do not propose any serious modifications as to the first four points. (1) They consider the experiments established the superiority of the electric light, as exhibited at the South Foreland, under all conditions of weather. (2) They indorse the statement made as to the relative efficiency of gas and oil for revolving lights. (3) With the fixed lenses they attribute the superiority of gas chiefly to the fact, that, as the light is condensed by the optical apparatus in vertical planes only, the inferiority of the oil-light, as regards the initial quantity emitted, is not compensated for, as with annular lenses, by its superior condensation arising from the smaller width of the flame. (4) While admitting that the photometric measurements establish the superiority of the Douglass over the Wigham burners, as regards economy and efficiency arising from greater concentration of light, they state they have no information as to whether the employment of glass chimneys forms any serious drawbacks. It was the fifth recommendation of the original report that was most strenuously objected to by the advocates of gas, since it practically rejected that illuminant. It is now somewhat modified in form, and the use of gas is referred to, although scarcely recommended. We are now told, (5) “Though gas possesses undoubted advantages over oil in some respects, such as facility in increasing the power on the sudden occurrence of a fog, absence of the necessity of trimming, power of making instantaneous transition from light to darkness, and conversely, we do not think these advantages sufficient to outweigh the advantages which mineral oil possesses for ordinary employment on account of its simplicity and economy. We think, too, that for specially important sea-lights the experiments show that electricity offers the greatest advantages. At the same time, we see no reason for confining the choice to these two alternatives; nor does it appear that the words of the report so confine it. There may be special reasons in particular cases for giving the preference to gas, and it seems even desirable that mariners should have the opportunity of witnessing the effects of different systems, which would thereby be subjected to the test of long continued practical experience.” As to the latter part, mariners have long had the opportunity of witnessing the effects of different systems, for several splendid gaslights are to be seen on the Irish coast, while there are electric lights on different parts of the coasts of Britain. Oil-lights, of course, are common enough.

It is not altogether to be wondered at that the Trinity House is disinclined to adopt gas in the present impoverished state of the Mercantile Marine Fund. In the days when that fund was overflowing they could have done so with ease, but now they have only a limited sum to spend on lighting our coasts, and therefore have to make it go as far as possible. The addition of a gas-making plant to a lighthouse means a considerable initial expense, and possibly an increase of working charges. During foggy weather the

light may have to be kept on for several days, and, unless the storage capacity were great, a man would be required specially to work the retorts. Now, since oil-burners are pronounced practically equal to gas for revolving lights, while for fixed lights a great power is not required, it is probably better economy to multiply lighthouses than to increase the outlay on those existing. Besides, the limit of the power of oil-lamps has certainly not yet been reached, and, urged by the rivalry of gas, it is certain that we shall get more powerful burners. Even before the South Foreland experiments were concluded, new and more effective types of burners had been constructed. In places where both light and power are required, as at Ailsa Craig, where there are siren fog-signals in addition to the lighthouse, gas is pretty certain to be adopted in the future, as it simplifies the attendance on the light, and is always at hand to start the air-compressing machinery in case of sudden fog. The production of gas by the distillation of petroleum is so simple that it can easily be learned by the class of attendants employed in lighthouses, and does not sensibly increase the chance of a break-down. It is a pity that the most interesting quality of gas-illumination, that of sky-flashing, was not more fully investigated. This seems to be full of promise. Often the thickness of a fog, measured vertically, is very small, and an intermittent light projected on to the sky could be readily seen. Every one knows how the attention is caught by sheet or summer lightning, in which the arch of the sky is momentarily lit up by a flash which is below the horizon, and therefore out of the range of direct vision. Even if the observer have his back to it, he can scarcely fail to see it. According to Sir L. McClintock, something of the same effect can be produced by a sudden burst of flame, produced by turning gas on for a moment before it is lighted. The condition of a mariner groping his way up channel in a thick fog is so dangerous that every expedient that promises to aid him is worth investigation. There are sufficient lighthouses where gas is used to enable this to be tried with scarcely any expense.

THE ARMY-WORM IN MARYLAND.

IN accordance with Professor Riley's instructions, on May 31, accompanied by Mr. Albert I. Hayward of the Maryland Agricultural College, Mr. William H. Ashmead started for Salisbury, Wicomico County, and Princess Anne, Somerset County, Md., to make such observations on the army-worm (*Leucania unipuncta*), then depredating in the vicinity of these places, as the limited time at their disposal should permit.

During the journey (reported in the September bulletin of the United States Department of Agriculture) they ascertained in conversation that the worms were most numerous in the immediate vicinity of Princess Anne, and so they took the most direct route for that place.

As they approached their destination they began to see the effects of the worms' work. Just before entering the town, they passed by a large field of corn, owned by Mr. H. H. Deshields, containing about twelve acres, that had been devastated by the army-worm, and only a few green plants could be detected here and there in the field.

This field was in marked contrast with another corn-field adjacent, which had been saved from attacks by ditching, as recommended in the "Third Report of the United States Entomological Commission." Another thing observed was that this field was flanked behind with a wood that evidently prevented their ingress that way, whereas the former was contiguous to grass and wheat fields, in which the worms are said to originate.

Just before entering the town, another ten-acre corn-field was passed, owned by Mr. John L. Lormer, that but a short time previously presented a most promising appearance, but which is now completely "cleaned out" by the worms. It may be worthy of record, as the theory has been advanced that insects originate in just such places, that in an adjoining field were three old haystacks. Contrary to their expectations, they found the reports of their numbers not at all exaggerated; and the damage done is even worse than was anticipated, the wheat, corn, barley, and timothy of many of the farmers being totally ruined by them.

One of the most interesting places for observation visited was that of William J. Porter, a practical and energetic farmer, who, although he has fought the worms most vigorously, has suffered severely from their attacks. By means of ditching and by burning straw, he has been able to save part of his crops; but several of his fields of corn, timothy, and wheat were already ruined. He reported the worms much less numerous than they had been, but there were many thousands seen in his fields.

During their rambles Mr. Porter took them to one of the ditches he had dug to keep the worms out of a large corn-field. In this ditch he had sunk, every two or three yards apart, deeper pits, where they found the worms two and three inches deep; and the rest of the ditch was black with the dead and living worms. From the dead a fearful stench arose in such strength as to attract the buzzards, which were proudly sailing overhead. Various carrion beetles, too, seemed to revel in the carnage. Large silphids and staphylinids, besides numerous smaller forms, were quite numerous; while the hard-shelled histerids were quite plentiful working through the putrid masses. Several carabids were observed running through the ditches, preying on the living and dying; *Scarites subterraneus* Fabr. being particularly noticeable, and no doubt, with its large mandibles, doing efficient service in destroying the worms.

Mr. Porter informed Messrs. Hayward and Ashmead that the worms always originated in the wheat and old grass fields, and during the morning hid themselves from observation, never appearing in numbers until after three o'clock P. M., which accorded with their own observations and with those of the other farmers visited.

They ate up the timothy and corn clean, and, after devouring the blades of the wheat, congregated, three or four together, on the heads. After devouring several of the lower grains, they ate the husks and nipped off the upper portion of the kernel of the rest, thus almost entirely destroying it. If the grain is well advanced and somewhat hard, it escapes destruction; but, as most of the wheat visited was still in the milk, the destruction was great, and not less than 75 per cent of the crop had been already destroyed.

Although several parasites are known to prey upon the worms, and a sharp lookout was kept for such, none were seen except a few cocoons of an *Apanteles*, which were discovered, together with the worms, under old trash and logs in a wheat field. A few were gathered and forwarded to the Department of Agriculture, some of which have since hatched, and prove to be *Apanteles militaris* Walsh.

The corn-fields of all this region were found to be badly infested with the larvæ of two species of beetles; and so numerous are they at times as to entirely destroy the first planting, and necessitate a replanting of entire fields. The farmers call them the "bud-worm," and do not seem to be aware that they are two distinct species that do the injury.

One species is a well-known corn-pest, the larva of *Diabrotica vittata*, widely distributed over the United States; the other is one of the wire-worms, possibly the larva of a common beetle, *Drastarius elegans* Fabr., which also has an extended range, extending into Mexico. So far as known, this latter species has never before been reported as injurious to corn, as the larva is supposed to be predaceous on other insects. It may, though, have dual habits, not an unusual occurrence in some insects. Both of these species are more prevalent in low fields, the higher fields being less subject to their attacks.

Another beetle, found to be seriously injurious to cantaloupes and sweet-potatoes in this region was a chrysomelid, *Systema*

elongata Fabr., which was found swarming in numbers, skeletonizing the leaves, and frequently killing the young plants. Mr. Porter stated that he was compelled to replant on account of them.

On a neighboring farm, owned by Mr. Z. Rouch, almost as much damage had been done by the army-worm as on the former place. A large corn-field and a field of timothy were totally ruined. A wheat-field, further advanced than that of Mr. Porter's, was less seriously affected, although it did not escape entirely, the blades of the wheat and the young timothy being entirely eaten up by them. It was on this place that the effects of the worms on barley were seen. Quite a large field already in head was completely ruined.

In the afternoon probably the largest farm in the county was visited, that of the Hon. D. N. Dennis, comprising five hundred acres or more. No better place existed for the proper study of the pest, as the worms were swarming in all the fields by the millions, and it was just the proper time of day to see them most advantageously, four o'clock P.M. The ground was literally black with the crawling worms. Mr. Dennis had made no especial efforts to destroy them, although, like some of his neighbors, he had surrounded some of his fields with ditches in an attempt to keep them out of adjoining fields. It is believed that it would have been quite practicable to have destroyed many thousands with poisonous washes, or, as Mr. Porter did, by burning straw in the ditches, as the bottom of the ditches were black with worms.

This farm is divided by a central lane, on either side of which are fields of wheat, corn, grass, oats, etc.; and in passing through this lane the worms were found quite plentiful, crawling almost invariably in the direction of the prevailing wind.

One of the first fields passed was an immense wheat-field already in the head, and the worms could be plainly discernible on the ground all through it and on the stalks and heads. The worms, having already devoured the young timothy and other tender plants usually found growing there, the blades of the wheat, the husks, and a goodly portion of the kernels, evidently could not find sufficient food, and were now migrating to pastures new, the sides of the field being black with moving hosts seeking more nutritious food.

These, as well as all the others observed, were moving in a south-westerly direction,—the direction of the prevailing wind. They were apparently in all stages of growth, from little fellows not more than a quarter of an inch long, to the fully matured larvæ, and all got over the ground and every obstacle in their way with the most surprising rapidity. The fences, posts, and other obstacles in their way were no obstruction to their migratory instinct or their search for food. The fence-rails and posts were often covered with crawling worms, sometimes not less than a dozen worms being found on the top of a single tall post, while others were seen going up one side as others were going down the opposite. Some specimens were even found under the loose bark on the posts and rails, where they had probably crept for shelter. One specimen thus found was in the jaws of a large hairy spider, *Salicicus* sp.

Adjacent to this wheat-field was a large field of timothy, containing seventeen acres, the blades of which had been cut off by the worms as clean as cattle could have done. Mr. Jones, the overseer, said that this field would have harvested not less than three tons of hay to the acre, but that now it would not pay for the cutting.

At one side of this field, the side next the wheat, the worms had congregated in countless numbers, every square foot having not less than thirty to fifty worms. The worms were now coming out of this field and going into the adjoining wheat-field, and crossing the lane into the opposite fields in great numbers; and it was here that a flock of the common English sparrows, and a few robins picking out the smaller worms and feeding on them, were observed. Mr. Jones said that the English sparrows had been thus busily engaged for a whole week, and it is a pleasure to record here this fact in favor of the despised bird.

Some distance off from this field was another one of wheat, containing probably twenty acres, in which the worms were even

more numerous; and they had already sufficiently injured it to render the crop unprofitable to harvest. A deep, broad ditch had been dug along one side, and it was now, about five o'clock P.M., black with worms. It seemed a pity that these worms were not killed, as many of them were able to crawl up the sides, and escape into adjoining fields.

Facing this field was a large corn-field of probably seventy-five acres, of which fifty acres had already been destroyed; and there was but a slight chance that any of the corn still left would escape, although by ditching an effort was being made to save it. Of the fifty acres destroyed, thirty acres had already been replanted; and in the newly ploughed portion the worms were seen moving about in all directions, having just entered it from the adjoining wheat. It is probable that most of these will die of starvation or from the effects of the hot sun in the middle of the day.

Messrs. Hayward and Ashmead were particularly struck with what Professor Riley has written about the army-worm not feeding on clover. Of the several clover-fields they saw, the worms passed entirely through them, eating the timothy, other grasses, and some weeds, but leaving the clover almost untouched. A few of the leaves and some of the heads were slightly eaten, but no appreciable injury was observed. Only once did they actually observe a worm eating it, and that was a single half grown specimen curled up on the head, devouring the most palatable portions.

The present outbreak seems to be quite local, within a radius of ten to fifteen miles; and of the origin and previous outbreaks but little was ascertained. All the farmers and others interviewed concurred in the opinion that the winter of 1889-90 had been unusually mild and dry, and a few reported having observed the worms feeding on warm days during the winter.

On the following day they visited Salisbury, but found nothing of importance to prolong their stay there. Messrs. L. Malone and W. B. Tighlman said that the army-worm had not as yet appeared on any of the farms in the immediate vicinity, and no serious injury had been done nearer than three miles.

Mr. Tighlman reported the oat-crop of this whole region this year a total failure from the depredations of the grain aphid, *Siphonophora avenæ* Fabr.

WHEAT-SMUT.

THE August Bulletin of the Kansas Experiment Station contains the report of an exhaustive experiment in the prevention of the stinking-smut of wheat, the results of which are so valuable that they should have the widest possible dissemination.

It is a well-known fact that smut and similar growths are due to parasitic fungi, which propagate by spores (similar to seeds of other plants); these spores being, in the case of wheat-smut, the black stinking-powder that is found inside the smutted grains. In threshing, these grains are broken, and the spores are scattered over healthy grains, with which they are planted and on which they take root and grow, sending up in the issues of the young plant microscopic threads, which grow with its growth; and when the wheat heads out, they penetrate the grains, and there absorb the nutriment intended for the grain, and convert it into the fetid smut.

Knowing this history of the smut, it is easy to understand that any treatment that will kill the spores of the smut on the seed-grain will reduce the injury to the following crop. It has long been known that this might be accomplished by soaking the seed-grain in solution of sulphate of copper (blue vitriol), but this process has the disadvantage of injuring the vitality of the seed-grain. The Kansas experiment was undertaken with a view of ascertaining whether the desired object might be accomplished without this injury. In this experiment fifty-one different methods of treatment were employed. Some killed the grain as well as smut; some did little or no good. The most effective treatment was found to be simply scalding the seed,—a method first published by J. L. Jensen of Denmark.

To accomplish this, the seed should be handled in loose baskets, such as will permit the water to pass readily through them. It should first be dipped in water warmed to from 110° to 120°,

otherwise the scalding water will be cooled too much; then dip it in a large vessel containing water heated to not less than 132° and not exceeding 135°. Shake or stir it thoroughly, so that the water will reach every grain. Remove the basket occasionally, and add boiling water until the temperature is brought up to the proper point. Keep it in hot water fifteen minutes, then spread out to dry. If this work is thoroughly done, the smut-spores will be destroyed without any injury to the wheat.

DRIED BREWERS' GRAINS.

THE dairymen of our larger cities and towns who live in the neighborhood of large brewing establishments have long recognized refuse brewers' grains as excellent food for milch cattle.

In brewing, says Mr. William Frear, in Bulletin No. 12 of the Pennsylvania State College Agricultural Experiment Station, the barley is first started to germinating, by which most of the starch is changed to maltose, a soluble compound related to sugar. At the proper stage germination is arrested by drying the grains; and the sprouts, which would impart undesirable qualities to the "wort," are removed by stirring and screening. The maltose is then extracted from the grain by hot water to form the wort, or liquid in which alcoholic fermentation is to be set up. The grain left after the wort is drawn off is known as "brewers' grains."

It is a very watery material, expensive to carry great distances, and difficult to preserve, being highly fermentable. Since, however, it contains nearly all of the nitrogenous matter of the original grain, with a much smaller percentage of starch, it forms, in spite of its watery condition, a very important cattle-food.

It has heretofore been found difficult to dry it economically, so as to make its preservation and transportation possible. Recently the Pabst Brewing Company of Milwaukee, Wis., have dried the grain at a low temperature by means of a vacuum process, and without the removal of the last traces of wort by pressure.

An analysis shows that out of the 21.50 per cent of proteine, 17.44 per cent consists of true albuminoids. Careful tests showed no traces of sugar left in the grains, and only 3.17 per cent of starch.

In composition it lies, in most respects, between linseed-meal and wheat-bran, save that it has nearly twice as much fibre. Malt sprouts are somewhat more highly nitrogenous, and contain only about half as much fibre, but they contain only one-ninth as much fat, which, in this case, is probably very largely digestible and of high nutritive value.

If placed upon the market at such a price as to compete with other foods of its class, it will undoubtedly, according to Mr. Frear, prove a valuable addition to the list of highly nitrogenous by-products useful as cattle-foods.

NOTES AND NEWS.

THERE is some difference of opinion as to the original meaning of the word "kangaroo." At the meeting of the Linnean Society of New South Wales on Aug. 27, says *Nature*, the question was discussed, whether, in the dialect of the blacks of the Endeavour River, the word signified "I don't know," and was so used in answer to the queries of Capt. Cook's party, or whether, as Cook supposed, it really was the name of the animal in use among the aborigines of the locality.

—Mr. Cecil Carus-Wilson writes to *Nature* that he has invented a luminous crayon for the purpose of enabling lecturers to draw on the blackboard when the room is darkened for the use of the lantern. He hopes that the invention may prove of value not only to lecturers who use a lantern, but also (in another form) to those students who wish to take notes.

—In a long series of articles a native Japanese paper gives some interesting figures about the students of Tokio (republished in *Nature*). There are 107,312 students in the whole empire in the various colleges and other high schools (primary schools and ordinary middle schools excepted). Of this number, 38,114 represent students prosecuting their studies in the capital; that is to say, about 40 per cent of the whole number are congregated in

Tokio. Among the 38,114 students, 6,899 are domiciled in Tokio, so that the number of those coming from other localities is 31,215. The amounts which individual students spend vary from \$7 or \$8 to about \$15 per month. Taking the average, it may be assumed that each student spends \$10 a month, or \$120 a year. Thus the total amount of money annually disbursed by these lads is a little over \$3,700,000. In other words, money aggregating over three millions and a half is being yearly drawn from the provinces to the capital through this channel. The provinces receive little in return, for few of the students ever go back to their homes, their sole ambition being to remain in the capital, and there rise to eminence in some walk of life.

—Since the preparation of the article by Professor Angelo Heilprin in *Science* of Nov. 7, Mr. Israel C. Russell has made a preliminary report on his researches (in conjunction with Mr. Kerr) in the St. Elias region,—researches undertaken under the auspices of the National Geographic Society. The measurements of Kerr, as reported at length in some of the daily papers, give for the height of St. Elias *less than* 15,000 feet, which thus places Orizaba pre-eminently to the first place among North American mountains.

—At a meeting of the executive committee of the National Electric Light Association held at the Electric Club, New York City, Nov. 7, the date for holding the thirteenth convention was fixed for Feb. 17, 18, and 19, 1891. Eugene F. Phillips of Providence, where the convention will be held, was appointed chairman of a committee of five, on reception and arrangements, he to appoint the other members of the committee. Gen. C. H. Barney of New York was appointed chairman of a committee of three on electrical exhibits and transportation, he to appoint the other members of the committee. The committee on papers reported the following as promised, and stated that the prospects of securing two or three more important papers are most excellent (announcements of these will be made later): "How can the National Electric Light Association best serve Central Station Interests?" by C. R. Huntley, discussion by A. M. Young; "Distribution of Steam from a Central Station," by F. H. Prentiss, discussion by George H. Babcock; "Distribution and Care of Alternating Currents," by T. Carpenter Smith, discussion by G. H. Blaxter; "Municipal Control of Electric Railroads," by M. W. Mead, discussion by M. J. Francisco; "The Ferranti System," by C. B. Haskins, discussion by C. L. Edgar. The committee has not only secured the promise of these papers, but has gone a step further, and named a person to open the discussion on each paper. This must inevitably tend to bring out the best points of the topic, and to greatly add to the interest in and value of the proceedings.

—If we were to judge by statistics alone, says *Nature* of Oct. 16, we should be forced to conclude that the present system of granting rewards for the destruction of wild animals in India has had little or no effect in diminishing their numbers or in decreasing the mortality caused by them. This conclusion, however, would not be in accordance with facts. The methods according to which the statistics are collected have been so much improved, that no deduction can safely be made from the figures available. This is pointed out in a recent report of the Revenue Department of the Government of Madras. The report continues, "The experience of almost every district officer who has been some years in the country would be that the number of destructive wild animals had largely decreased with the advance of cultivation and the progress of railways, and the evidence of natives would probably be the same. There are parts of the country still, where, owing to the existence of forest and difficulty of access, wild animals of prey continue to exist in large numbers; and it is the case, that, owing to various causes, Europeans, at all events, do less now in the way of killing large game than formerly was the case. They have less time to spare from their official duties, and less money to spend. It can hardly, however, be doubted, that, owing to the existence of the system of granting rewards for animals slain, native shikaris are encouraged to maintain a profession which otherwise probably they would give up from want of support; and for this reason, if for no other, the board would not wish to see at present any change made in the system of granting re-

wards. It may be hoped that the construction of the East Coast Railway, and the branch from it through the heart of the Vizagapatam district to the Central Provinces, will tend in a great measure to reduce the number of wild animals in the districts where they now do very considerable damage. Cultivation and population in tracts now given up to jungle and grass will increase largely, and the need of wood for the railways will lead probably to the destruction of large areas of jungles, which now exist in tracts which should be devoted to agriculture."

—The Cornell University Experiment Station has made a series of experiments in setting milk for cream-raising by different methods, the results of which, as summarized in Bulletin No. 20 of that station, are as follows: in eleven trials where the milk was set in the Cooley creamer with ice-water at a temperature of 44°, the average per cent of fat in the skim milk was .23; in eleven trials where milk was diluted with an equal weight of cold water, and set in the open air, the average per cent of fat in the skim milk was 1.38; in six trials where milk was diluted with 20 and 50 per cent of cold water, the average per cent of fat in the skim milk was 1.24; in ten trials where milk was diluted with 10 to 100 per cent of its weight of hot water, the average per cent of fat in the skim milk was 1.11; in two trials where milk was set in deep cans without dilution, in running water at 60° to 63°, the average per cent of fat in the skim milk was .89; in two trials where milk was set in shallow cans, at 60° and 64°, the average per cent of fat in the skim milk was .48; in one trial where milk was set in shallow pans, and one-third of its weight of water at 120° added, the per cent of fat in the skim milk was .75.

—Plans, and estimates of time and cost of construction, will be received by Professor R. H. Thurston, director of Sibley College, Cornell University, not later than Dec. 25, 1890, for an experimental steam-engine, such as is customarily made a part of the equipment of technical schools of the higher class, and used by them in researches in steam-engineering. This institution already has a number of engines adapted in various ways for this work; but it is desired that one should be there installed which shall present peculiar facilities for illustration, and for investigations in connection with the higher graduate courses of instruction, and in the schools of steam-engineering, of marine engineering and naval architecture, now making preparation for their work, and in the school of railway mechanical engineering which it is anticipated may be organized should the former prove useful and successful. Plans, and estimates of cost of construction and of time required, will be received also from builders of testing-machines not later than Dec. 25, certain conditions being prescribed.

—The Harveian oration was delivered by Dr. Andrew on Saturday, Oct. 18, at the Royal College of Physicians. In the course of the oration, as we learn from *Nature*, Dr. Andrew referred to the fact that the relationship between physiology and medicine has in many ways greatly changed during the last two hundred and fifty years, and that such change is a necessary consequence of the progress made by physiology. "The goal of physiology is truth, e.g., perfectly trustworthy knowledge of a certain class of facts and laws; and this independently of any use, good or bad, to which that knowledge may be put. The goal of medicine is power; e.g., ability to manipulate certain given forces in such fashion as to produce certain effects. No doubt theoretically the two ends coincide, and we may hope in some remote future they will do so in reality and perfectly. For the present we must be content with having in one direction much knowledge which confers little or no power, and, on another side, very imperfect knowledge which yet brings with it very great power, too often ill directed. Again, their methods are different. Physiology by slow degrees has come to rely more and more on purely scientific modes and instruments of research, and to apply them by preference to matters which can be brought to the test of direct experiment. Medicine, on the other hand, has no choice but to remain, so far as it has a scientific side, a science of observation; for any thing like effective investigation of the matters with which it deals by direct experiment is impossible. As physiology slowly reduces to order the apparently hopeless confusion of so-called vital actions, the easiest questions are attacked and answered first, and thus

those which have to be faced later in their turn are more and more difficult, more and more refractory to scientific analysis. Now, these more difficult questions are often of vital importance to medicine, and in them lie dormant vast possibilities of increased knowledge of the nature of disease, of increased power over it. And yet, from the great difficulty of subjecting them to experiment, physiology may seem for a time to fail us, and the task of employing physiological results to explain clinical facts, or to form the basis of rational treatment, becomes harder than ever."

—In the great experiments of Sir John B. Lawes, which have been conducted on Rothamsted Farm for more than forty years, potash seems to have had no effect as a fertilizer for wheat, except when combined with both phosphoric acid and nitrogen. In the experiments now in progress at the Ohio Experiment Station, potash seems to have no effect on wheat, whether used alone or in any combination. At the experiment station of Kentucky (at Lexington), potash has produced a very marked increase of crop when used on corn, hemp, tobacco, and potatoes; but here, again, it fails to increase the yield of wheat, whether used alone or in combination, as indicated by experiments published in Bulletin No. 30 of that station, for August, 1890. The Ohio and Kentucky experiments are as yet in their infancy; and it is probable, that, as the soil becomes more worn, even wheat will show some benefit from applications of potash; but the present indications are that this substance is seldom needed in fertilizers intended for this crop. It may be that the clover following the wheat will make good use of the potash, but this point should be determined by experiment, not by guess-work.

—In the numerous experiments in feeding hogs conducted at the Agricultural Experiment Station of the University of Wisconsin, where corn-meal was the exclusive feed for a considerable length of time, it has been found that the bones of animals so fed are less strong in breaking-tests than the bones from hogs receiving other feeds. The question naturally arose as to the ability of Indian-corn to supply ash material for building up strong frames in animals to which it was fed. Successful feeders and observing farmers have long recommended the use of charcoal and hard-wood ashes for hogs, especially during periods when large amounts of corn were fed. Their experience with weak bones, and the ideas held by feeders, led the station to experiments in which hard-wood ashes were fed to some hogs receiving corn, and withheld from others. Knowing that meal made from the bones of animals, usually used for fertilizer, contains large amounts of phosphorus and lime, it was deemed proper to feed this at the same time that ashes were being fed, in order to ascertain if it was superior to ashes. In the sixth report of this station, two experiments in this line are given. Desiring to settle the question more definitely, the work was continued, and report made of two additional experiments, with the following results: 1st, that the effect of the bone-meal and ashes was to save about 130 pounds of corn, or 28 per cent of the total amount fed in producing 100 pounds of gain, live weight; 2d, that by feeding the bone-meal the strength of the thigh bones was doubled, and ashes nearly doubled the strength of the bones; 3d, that there was about 50 per cent more ash in the bones of the hogs receiving bone-meal and hard-wood ashes than in the others.

—The "Listener" had a most curious thing happen to him not many nights ago, as he states in the *Boston Transcript* of Nov. 3. He was asleep, and dreamed persistently of a gentleman of his acquaintance whose name is Hale. Nothing in the events or changes of his dream could get this Mr. Hale out of the foreground: he was always there; he did not transform himself into anybody else; he did not do any thing in particular nor say any thing in particular; he was simply Mr. Hale, and seemed to be there solely for the purpose of being Mr. Hale, and enforcing his constant, steady, vivid personality on the presence of the dreamer. This went on for some little dream-space, and then the dreamer awoke. It was in the middle of the night. His first conscious thought or perception was that it was raining very hard on the zinc roof of the porch. The rain seemed to beat down with immense violence. He rose to close a window, thinking that the water would beat in. As he advanced toward the window, the

storm ceased suddenly. "Why," said the "Listener" to himself, "that was like the sudden ceasing of a hail-storm." A queer thought about the dream came to him. He lighted a lamp, and looked out upon the roof of the porch, and there were many little heaps of fast-melting hail stones. Now, had the pelting of the hail upon the roof suggested that dream-presentation of the personality of Mr. Hale? Very likely it had. But by what process of consciousness? Evidently the dreaming consciousness or perception was superior to the waking consciousness; for, if the storm suggested the dream at all, the dreamer must have been aware that it was hail that was falling, in order that Mr. Hale should come forth; but, when he really woke from sleep into full consciousness, he took the storm for rain, and there was no thought of hail in his mind. It is a nut for the psychologists to crack, if they think it worth their while.

— During the month of August last, the Mediterranean fleet of the French Navy was supplied with a captive balloon for the purpose of reconnoitring. The balloon, according to *Engineering* of Oct. 24, was constructed at the military balloon works at Calais Meudon, and has a capacity of 11,300 cubic feet. It is inflated with hydrogen, which is carried in reservoirs under a pressure of 100 atmospheres. A tail-rope 130 feet long, which for lightness is best made of silk, serves to connect the balloon with a ship of the fleet. A number of ascents have been made with the balloon from the armor-clad "Formidable," the tail-rope being connected to the top of one of the military masts. Many officers of the vessel have made ascents, and are unanimous in their praise of the apparatus. On a clear day all important objects within a radius of eighteen to twenty-four miles can be clearly distinguished. Another important point is that the waters of the sea, when observed from a considerable altitude, are singularly clear, and the details of the bottom were in some of the ascents clearly distinguishable, even at depths of 80 feet. This peculiarity allowed an observer in the balloon to follow the movements of the submarine boat "Gymnote," during its recent trials, without losing sight of it for a single instant, whatever its depth of immersion. The balloons used are very stoutly constructed, and in September last one was towed at a speed of $10\frac{1}{2}$ knots per hour for a distance of 21 knots by the torpedo-boat "Audacieux" without suffering the slightest damage. It may be remarked, in conclusion, that Germany has also adopted balloons for naval purposes, and, during the recent manoeuvres at Wilhelmshaven, one of these was used from the war-ship "Mars" for reconnoitring.

— The first determination of the moon's mass was made by Newton in 1687, from the tides, and other investigators have since employed the same method, but for more than one hundred and eighty years it yielded no trustworthy result. Its failure was due to various causes, both theoretical and practical; and, although some of these were cleared up by La Place as early as 1818, there was little prospect of success until the recent application of harmonic analysis to the reduction of continuous observations of the tides, recorded by automatic gauges, and extending over long periods of time. Long ago Airy showed why the moon's mass cannot be accurately determined from the mere ratio of the solar and lunar effects in the semi mensual inequality of the tides; but nevertheless many of the values recorded have been obtained in that very way, and are therefore worthless. Those found by La-Place's method, or by Ferrel's modification of it, are theoretically correct, at least for deep-water tides; but, instead of confining himself to them, Professor William Harkness of the Naval Observatory, Washington, has computed many new values from the "Results of the Harmonic Analysis of Tidal Observations," which have been published by Major Baird and Professor Darwin. The final result of Professor Harkness's work is—

$$\text{Mass of Moon} = 0.012714 \pm 0.000222.$$

— A memorandum, together with a sample of the plant, lately received from Sir Alfred Moloney, the Governor of Lagos, says the *Journal of the Society of Arts* (London) of Oct. 24, gives an account of the endeavor he is making to encourage the exportation of the fibre known as "African bass,"—the fibre of the bamboo-palm (or *Raphia vinifera*). The bamboo-palm (*Raphia vinifera*) is perhaps the commonest tree in the swamps and lowlands which

line the waterways of the colony. Dense thickets of these palms, traversed only by the palm wine-gatherer or the bamboo-cutter, push their way into the lagoons, and extend over the flood grounds, and even to a distance of from fifteen to twenty miles up the river-valleys into the interior. The area occupied by these *Raphia* forests it would be impossible to calculate; but it may be accepted without doubt that they extend throughout the length of the colony, and to a distance of at least fifteen miles from the seacoast, and that over this area of about five thousand square miles they form a considerable proportion of the vegetation, next only in numbers to the oil-palm (*Elaeis guineensis*) and the mangrove (*Rhizophora mucronata*). The fibre itself is the one in most common employment on the coast, being used by the natives for all sorts of purposes,—cloth, cordage, thatch, fishing-lines, etc. The cost is only that of collection and preparation, the latter being a very simple process of soaking and scraping. The price, delivered in England, is said to be from \$150 to \$160 per ton for good fibre. The cost of production is estimated at \$70 per ton; shipping and other expenses, at \$22.50.

— Some time since, Mr. Albert Koebele, the California agent of the Division of Entomology of the United States Agricultural Department, was instructed to collect and forward to Mr. Wight in New Zealand a number of living specimens of a common *Raphidia* which he had found to destroy the larva and pupa of the codling-moth in California. This was done as a partial return for Mr. Wight's kindness to Mr. Koebele when he was in New Zealand in the spring of 1889, collecting the insect enemies of the fluted scale. Recent letters from Mr. Wight, and an article in the June number of the *New Zealand Farmer*, state that the shipment arrived in fairly good condition, although it was opened for examination, and held for ten days, at the custom-house. Twenty-one specimens were sent, each one in a small box with moss, and the whole enclosed in a strong wooden box. Mr. Wight found pupæ in sixteen of the boxes, and a larva in one; while three were empty, probably owing to the custom-house examination. The single larva was hungry and very attenuated, and it at once attacked and devoured a codling-moth larva twice its own size. It was so stretched out and distended that at first, not discovering the absence of the codling moth larva, Mr. Wight thought it was entering the pupa state; but it presently resumed its usual appearance, and finished several more larvæ. The result of this importation is looked forward to with great interest. The genus *Raphidia* is represented in this country only upon the Pacific coast, and it is not at all likely that it will flourish East. An attempt, however, will be made to introduce this ravenous creature into some of our Eastern apple-orchards.

— Next to the cabbage-worm, the worst insect enemy of the cabbage is the aphid, or plant-louse, which is so often found upon the leaves and in the heads in great numbers. This is a small, bluish-white insect, that subsists upon the sap of the plant, and multiplies with great rapidity. Like most of the peculiar family to which it belongs, this insect has the power, not common among insects, of bringing forth living young; but with most of those that have been carefully studied there is in the fall a sexual generation by which the true eggs are laid, and in this egg state most of them pass the winter. But although the cabbage aphid has been known both in Europe and America for more than a century, the sexual generation has never heretofore been found, and entomologists did not know where or when the eggs were laid, nor how the insect passed the winter. Recent investigations, however, carried on at the Ohio Experiment Station by Dr. C. M. Werd, have shown conclusively that the sexual generation develops late in autumn on the cabbage, and that the eggs are laid on the cabbage-leaves. The true male is a small winged creature, with a more slender body than the other winged forms. The egg-laying female has no wings, and is pale green in color. This discovery of the fact that the insect passes the winter in the egg state on the cabbage-leaves has an important economic bearing. It suggests, as one of the best ways of preventing the injuries of this pest, the destruction during winter of the old cabbage-leaves with the eggs upon them, instead of leaving them undisturbed until spring, as is too often done.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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CONTENTS:

LIGHTHOUSE ILLUMINANTS	267	LETTERS TO THE EDITOR.
THE ARMY-WORM IN MARYLAND ..	269	Origin of Right-handedness
WHEAT-SMUT	270	William James 275
DRIED BREWERS' GRAINS.....	271	Mount St. Elias. Wm. H. Dall.. 275
NOTES AND NEWS.....	271	Chalk from the Niobrara Cre-
		taceous of Kansas
HEALTH MATTERS.		George M. Dawson 276
Treatment of Consumption.....	274	BOOK-REVIEWS.
Medical Treatment of Fractures	274	Races and Peoples..... 276
The International Medical Con-		The Trees of Northeastern Amer-
gress at Rome.....	274	ica..... 277
Color-blindness among the Chi-		The Antiquities of Tennessee... 277
nese	274	AMONG THE PUBLISHERS..... 277
Possible Dangers of Hypnotism.	274	

HEALTH MATTERS.

Treatment of Consumption.

FROM the *Lancet* of Aug. 30 we learn that Koch's views on the treatment of *phthisis pulmonalis* have received interesting support from the experience of a chemist, Herr Reuter, made public in April last at a full meeting of the Lower Austrian Industrial Union. Koch, it will be remembered, maintained at the Berlin congress, that, among the remedies capable of bringing the malady to a standstill, the salts of gold and silver are of the greatest value, and that among these the first place must be given to "cyan-gold." Reuter, who, as director of the great *fabriques* of metallic wares at home and abroad, paid particular attention to those in which the articles in question were galvanically gilded or silvered, observed that in the latter industry the employees who had consumptive or tubercular symptoms, some indeed who suffered from hemoptysis, found marked relief in their work, and continued to improve so rapidly that in a few weeks their return to health was assured. The favorable impression made on Reuter as to the curative effects of the gold and silver industry on phthisis, he found confirmed by the testimony of employees of every age in these establishments; men, young and old, who had the well-known symptoms of pulmonary consumption, even at an advanced stage, rapidly getting well as they continued from week to week at work. Further investigations strengthened that impression still more, till he had satisfied himself that for the disease in question a healing virtue resides in the prussic acid generated

particularly in those workshops where "cyan-metals" dissolved in "cyan-kalium" are used. Impressed by Koch's views, the Medical Association of Vienna has since bestowed special consideration on Reuter's experiences embodied in the paper read before the Lower Austrian Industrial Union last April, and, while admitting the confirmation given to those views by Reuter, it is of opinion that the honor of priority in discovering the efficacy of gold and silver salts in the treatment of *phthisis pulmonalis* belongs undoubtedly to the latter.

Medical Treatment of Fractures.

In a graduation thesis in Havana an author discusses the advantage of prescribing various forms of phosphorus for patients suffering from fracture. As given in the *Lancet*, he carried out a series of experiments on dogs and fowls by breaking the femur by means of an osteoclast, and putting up the limb in splints. He then divided the patients into two groups, the first group being treated with phosphorus in various forms, the second being left without medication. The result was that the callus was more abundant and firmer in animals treated with phosphide of zinc than in those treated with phosphate of lime or than in those not treated at all. These results were confirmed by observations made in the surgical wards, where it was found that patients with fractures who took from a quarter to an eighth of a grain of phosphide of zinc daily made exceptionally good and rapid recoveries. The only unpleasant effects produced by this treatment were that one out of the eighteen patients on whom it was tried suffered from slight diarrhoea, and in one the pulse became slow and hard.

The International Medical Congress at Rome.

Dr. Guido Baccelli, president of the Accademia Medica of Rome, and professor of clinical medicine at the Sapienza, took the chair at a recent meeting of the Società per il Bene Economico di Roma, to consider the means of insuring the success of the International Medical Congress to be held three years hence in the Eternal City. Among the adjuncts to that congress, as we learn from the *Lancet*, it was decided to form an international exposition of hygiene in connection with the sanitary department of the programme, and, with that object, to appeal to all the leading industrial and professional centres throughout the peninsula to contribute their best and latest additions to the "Armamentarium Hygienicum," so as to place Italy at as great an advantage as possible in the inevitable contrast between her own sanitary work and that of the other powers represented on the occasion. Florence, which has hitherto led the van in hygienic progress in Italy, has already promised her energetic co-operation; and other cities, like Turin and Milan, are expected to do likewise. Concurrently with the medical congress, an international exposition of the industries of all nations is also being organized; so that Rome will be the busy scene of quite a gathering of the peoples, on a scale she has not yet known since she ceased to be mistress of the world. The early summer months (May or the beginning of June), or the early autumn months (the latter half of September or the beginning of October) are likely to be those selected for the medical congress, all risk of malaria at either time being improbable.

Color-Blindness among the Chinese.

Six hundred men and 600 women were examined by Dr. Thomson's stick of Berlin wool-tests. In this number, according to *The Medical Analectic and Epitome*, 20 color-blind were met (19 men and 1 woman). Of the 19 men, 13 were completely green-blind, 5 were completely red-blind, and 1 incompletely red-blind; the woman was completely green-blind. The 19 color-blind men were divided thus: 11 farmers, 2 teachers, 1 hospital assistant, 1 preacher, 1 mason, 1 boatman. There was almost a universal lack of discrimination between green and blue. The tests were not well adapted for proving what was suspected,—that many Chinese are violet blind.

Possible Dangers of Hypnotism.

As long ago as 1784 some of the dangers of hypnotism were pointed out by De Puységur, a pupil of Mesmer. The danger to which he referred more particularly was the criminal use which

an unprincipled person might make of the ascendancy gained over the subject. These warnings, frequently repeated, are not without reason, as the annals of crimes committed during the last sixty years abundantly prove.

But these are not the only sources of danger; for experience has abundantly shown that the subject himself may be prompted to commit theft and other species of crime after emerging from the hypnotic condition. This fact has become the subject of special judicial enactment in several countries.

Finally, the repeated hypnotization of the subject is liable to be followed by more or less dangerous consequences to himself. Inordinate emotionality, impairment of volition, and a tendency to become spontaneously hypnotized, or at least excessively drowsy, are some of the more obvious features of this post-hypnotic condition. Dr. J. Leonard Corning has at the present time under his care, as we learn from the *Medical Record* of Nov. 8, a gentleman who exhibits this neurosis—for neurosis it certainly is—in a striking manner. He is a man of rare gifts, he has maintained and still enjoys a high position in the community, and yet his mental decrepitude is so obvious that it is a matter of astonishment that he has been able to disguise its source so long. Currently he is regarded as a sufferer from mental overwork, and Dr. Corning confesses that he should have had great difficulty in arriving at the true nature of his difficulties, had the patient not confessed that he had been hypnotized scores of times, and that his present infirmity had come on as the direct result of these abuses, for abuses they certainly were.

Such a person as this is, of course, exposed to manifold dangers; for he had become so susceptible, that not only is it possible for any one to hypnotize him, but he is able without further assistance to induce in himself the sleep-like state.

Here, then, are the more manifest dangers of hypnotism.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Origin of Right-handedness.

PROFESSOR BALDWIN, in *Science* for Oct. 31, gives some interesting observations of his own on the development of right-handedness in an infant. He thinks the fact that the right hand began to be used in preference to the left only when the movement required an effort, is an argument in favor of those "feelings of innervation" whose existence many psychologists disbelieve, and challenges me (as a disbeliever) to explain the phenomena in any other way.

Why, asks Professor Baldwin, should the baby prefer her right hand for strong movements, unless previous experiences of using both hands had left behind them the sense that the nervous discharge that actuated the right one was stronger than that which actuated the left?

I admit that this is a possible way of explaining the facts; but yet, if a memory of the previous superior effectiveness of the right hand is what determines now the choice of it for these movements, it does not seem in any way clear that the memory in question need be of the *effluent* current of discharge (the printer has made Professor Baldwin say "afferent" instead of "effluent"). Why may it not be of the greater promptitude, security, and ease of the right hand's movement, as apprehended in an *afferent* way, during previous performances? Professor Baldwin gives no grounds for his rejection of this equally possible alternative. But to my mind it is by no means evident that memories of any sort of past performances play a part in the preference accorded to the right hand. On any theory we have to suppose antecedently to all memory a natural prepotency in the paths of discharge into the right arm. Professor Baldwin's own idea, that discharges into this arm leave images of their superior strength behind, implies that they *have* greater strength to begin with. Why, now, with this organic peculiarity, may they not also have

greater readiness to discharge when the stimulus reaches a certain amount? He who conceives of the mechanism of all these early movements as in principle the same as that of reflex action, ought, if he bears in mind the extraordinarily elaborate way in which different stimuli are correlated in the organism with different paths of discharge, to have no difficulty in believing the nerves which ran down into the right arm to be, on the whole, the most permeable paths of exit from the brain of such currents as run in from objects offered to the baby at a certain distance off. Grasping at such objects was the sort of performance which Professor Baldwin seems most to have observed. It is obviously an instinctive or semi-reflex act; and I should much rather explain it directly by connate paths alone, than by connate paths *plus* memories *plus* choice, after Professor Baldwin's fashion.

I must therefore conclude that Professor Baldwin's observations fail, in my opinion, to throw any positive light at all on the vexed question of whether we feel our motor-nerve currents as they pass out of our brain. In themselves, however, these observations seem very interesting as showing how strong stimuli may produce more definitely localized re-actions than weaker ones. The baby grasped at bright colors with the right hand almost exclusively.

WILLIAM JAMES.

Harvard University, Nov. 5.

Mount St. Elias.

As the National Geographic Society will shortly discuss the most recent observations on Mount St. Elias, with the full data of Messrs. Russell and Kerr as a basis, I have determined to refrain from taking any part in the newspaper discussion in regard to the height of this mountain or the respective value to be assigned to the different sets of observations due to different observers. This is the only scientific method to pursue; and it is due to those well qualified and energetic explorers that their results, when they are finally made known, should form the basis of discussion, rather than opinions, surmises, or guesses prior to their final computations. The only thing which can be definitely stated at present is that they are of the opinion that the mountain is lower than the height of late accepted for it, and the very rough preliminary computation of their observations appears to sustain this view. The weight to be assigned to their observations, and the final outcome of the revised computations, are matters for the future.

But the article by Professor Heilprin on the Mexican mountains, which you have reprinted (p. 260) under the title of the "Culminating Point of the North American Continent," no doubt unintentionally, but nevertheless seriously, misrepresents the methods by which my results of 1874 were arrived at; and, in the interest of a clear understanding of the subject, it is perhaps desirable that some of its fallacies should be pointed out.

Professor Heilprin is no geodesist, as his discussion of determinations of heights of over 17,000 feet, based on a single pocket aneroid barometer, is sufficient to show. A little inquiry in proper quarters would have made it clear to him that observations taken with such an instrument are far from determinative. If they happen to closely approach accuracy, it is merely accidental; and a range of 500 feet in the results would reflect in no way on the care of the observer or the known reputation of the instrument. They bear to the mercurial barometer much such a relation as sextant angles taken at sea for vertical heights do to those taken on land with a vertical circle or geodetic transit.

This want of familiarity with the subject has led Professor Heilprin into a singular misconception of the relative values of observations cited in my "Report on Mount St. Elias" printed in the "United States Coast Survey Report for 1875," and of the data which are given therein with absolute frankness and full detail.

In that report I aimed to embody every thing which might possess even an historic interest, and therefore printed results which I stated to be more or less unreliable for reasons which would be accepted by every competent judge of such matters. I stated that these results were not adopted by me nor incorporated into the work depending upon observations of a higher class. But

Professor Heilprin compares the irregularities of this bad material, denounced by me as bad, and concludes that it is good evidence for doubting the value of that which was considered to be more reliable. Such reasoning obviously affords only a *non sequitur*. I do not think any one who has passed laborious days and nights in the determination of angles by repetition and reversal will agree with Professor Heilprin that the system of "extracting averages" is "delusive;" and a reference to my report will show that it was a question of comparison of averages with a view to the weighing of methods with which, in that instance, I was concerned, which could hardly delude any one who chose to read what was printed on the pages before him. Averages may be made delusive, but not when used in this manner.

In conclusion, although the whole subject is one for experts and professional surveyors rather than others, I may summarize for those who are interested and unprofessional the main features of what was done in 1874 for the purpose of getting at the height of that unattainable peak.

In the determination of any height by triangulation, there are to be considered the character of the instruments, the distance of the peak, the vertical angle measured, and the refraction of the atmosphere, which distorts the line of sight and introduces an error, tolerably constant for high angles and short distances in ordinary latitudes, but irregular and sometimes very great in angles measured when the line of sight passes near the surface of the earth, especially for long distances and in high latitudes.

In the case of Mount St. Elias the distance depended upon a horizontal triangle observed from two astronomically determined stations, giving an astronomical base-line from which the lines converging on the peak were obtained by an astronomical azimuth. The value of such an intersection depends somewhat upon the size of the angle, which in this case was large, nearly 60°. The liability to error which very small angles of intersection may introduce was therefore measurably avoided.

The positions of the ends of the base-line were well determined. The circumstances of the observation made at sea were eminently favorable. The error of this position could hardly have exceeded three miles on the worst assumption; and the error of distance which this would produce in the base of the vertical triangle, upon which the height depended, was trifling. The instruments were first-class of their kind. The vertical angle measured, I venture to say, is beyond dispute. The uncertainty remaining, therefore, was in regard to the refraction,—a factor beyond our power to determine, and equally undetermined in all observations made to date.

However, the height of Mount Fairweather was tolerably well determined from positions near its base. We reasoned the error of refraction might be assumed to be the same for both mountains at the same moment, both being visible and not differing very greatly in their distance from our station. The difference between the height of Fairweather as measured from near its base, and that which we might obtain for it from our Port Mulgrave station, might be assumed to be due to refraction, and an analogous amount applied to the result for St. Elias as a correction for that unknown error. This was an assumption, of course, but a reasonable one, and was adopted.

The height of Mount St. Elias may very possibly be less than our results would show; but that they were likely to be correct within certain limits seemed probable, from the fact that angles measured by Malespina in the last century, the record of which is fortunately preserved, when computed with a corrected base-line in accordance with our observations for the position of the mountain, gave results approximating our own,—an apparent confirmation which was certainly impressive.

The outline of our proceedings is given, as above, in entirely untechnical language, but those who are professionally qualified to judge the character of such work are confidently invited to examine the report itself in the Coast Survey volume for 1875. This is somewhat amplified from the extra advance copies which were distributed before the publication of the volume. I make no pretence to the character of a geodetic expert, but the comparatively simple computations contained in this report were prepared and reviewed by those who are; and the error, if error there be in the

results, is due to factors which were entirely independent of the observers or the computers, under the circumstances.

Smithsonian Institution, Washington, D.C., Nov. 11.

WM. H. DALL.

Chalk from the Niobrara Cretaceous of Kansas.

REFERRING to Professor S. W. Williston's interesting communication in *Science* for Oct. 31, on microscopic organisms from the chalk of the Niobrara cretaceous of Kansas, I should suppose it to be highly probable that the forms met with by him are, as he supposes, coccoliths. Coccoliths are very abundant in, and sometimes form a notable proportion of, the calcareous parts of the Niobrara beds in Manitoba and in Nebraska, and are there associated with foraminifera and with rhabdoliths, to which latter class the slender, rod-like bodies, also noted by Professor Williston, may be referrible. Figures and a description of a number of varieties of coccoliths and rhabdoliths from the cretaceous of Manitoba may be found in the *Canadian Naturalist* for April, 1874 (p. 256).

GEORGE M. DAWSON.

Geological Survey of Canada, Nov. 10.

BOOK-REVIEWS.

Races and Peoples. By DANIEL G. BRINTON. New York, N. D. C. Hodges. 8°. \$1.75.

DR. BRINTON has undertaken the difficult task of presenting the whole vast field of anthropological science in a concise and readable form, and he has admirably succeeded in giving us a book that is attractive, and, in all its parts, suggestive. Therefore not only will it prove useful in making the public acquainted with the facts and some theories of ethnological science, but it will also incite the painstaking student to more thorough investigation of mooted questions, and open new vistas in many fields of research. Dr. Brinton's theories, even such as may not appear acceptable, are always full of ingenuity, and certainly worth the careful attention of anthropologists. The present book, notwithstanding the briefness with which necessarily all problems are treated, teems with new ideas and excellent critical remarks. In reviewing it, we must confine ourselves to selecting a few of the more important points. On the whole, we might wish that some still very doubtful theories to which the author adheres were not presented with quite as much assurance as finally settled.

The introductory chapter, on "The Physical Elements of Ethnography," strikes us least favorably. We think that not sufficient stress has been laid upon the great variations inside each race, and that too much is made of the peculiarities of the "lower" races, which in some respects might be called rather exaggerated human types than simian in character. The second chapter, "The Psychological Elements of Ethnography," is a succinct presentation of the chief causes governing the development of society. The author distinguishes associative and dispersive elements: the former including the social instinct, language, religion, and arts; the latter, the migratory and combative instincts. Dr. Brinton is inclined to consider the sexual instincts and the resulting parental and filial affections to be the prime cause of association, and rejects all theories based on promiscuity. The third chapter will be found full of interest, more particularly where the author sets forth his ideas regarding the development of man, as well as his classification of mankind. Although he knows how to present his views with much force, we cannot consider his description of the earliest stages more than an ingenious hypothesis, because we have so far no means of reconstructing the history of the period immediately after man had made his appearance. Dr. Brinton believes that mankind during the preglacial period was homogeneous, his industries paleolithic with simple implements, his migrations extensive, his language rudimentary. Such speculations can neither be proved nor disproved. Even the character of the glacial period, as described by Dr. Brinton, is largely hypothetical. He believes the migrations to have been limited at the time, the races to be living in fixed areas. It seems impossible to fix any period for these events which have certainly taken place at some time. The author's general ethnographic classification is based on physical characters. According to these, he distinguishes Eurafrian, Austafrian, Asian, American, and

insular and littoral peoples. These he divides into branches which are not very well defined, there being portions of a race separated geographically, linguistically, or otherwise, from other portions of the race. The branches are subdivided into linguistic stocks. This system is open to the same objection which must be made to Fr. Müller's: it is neither physical nor linguistic; and these two classifications, being based on entirely distinct phenomena, cannot be made to agree. The rest of the book is devoted to the discussion of the various races. The author sees the primal home of the Eurafian race in North Africa, whence he believes the Hamitic, Shemitic, and Aryan people derive their origin. The last he considers as a mixed race on account of the predominance of two distinct physical types. If we should apply this test to any of the better known peoples, we would have to class them among the mixed races. There is certainly no homogeneous variety of man in any part of the world. Therefore the reduction of the Aryan race to two prototypes seems somewhat doubtful. We cannot enter into the interesting sketch of the other races, but confine ourselves to the remark that the descriptions, though brief, are always striking and interesting. In a concluding chapter Dr. Brinton sums up a number of important problems,—those of acclimatization, race-mixture, and of the ultimate destiny of the races. The author emphasizes justly the close relations between ethnography and historical and political science. His work will undoubtedly greatly contribute to making this close connection better known and more thoroughly understood.

The Trees of Northeastern America. By CHARLES S. NEWHALL. New York, Putnam. 8°. \$2.50.

FOR its purpose, this book is admirable. The plan of the author was excellent, and he has carried it out well. There are defects in the book; but, as they are more of omission than of commission, they may be passed over with scarce a mention. In simple fashion and almost untechnical language, the author describes our trees, from their foliage, bark, and general appearance, so that they may be readily identified by persons without even a smattering of botanical knowledge. The trees described include all the native trees of the northern United States east of the Mississippi, as well as those of Canada. Mention is also made of the more important of the introduced and naturalized species. The work is so arranged that any given specimen can be readily found by help of a well-arranged guide. The author's chief authority for the geographical distribution of the different species is Sargent's report in the "Tenth Census;" and for the scientific nomenclature adopted, Mr. Newhall acknowledges his indebtedness to Professor N. L. Britton of Columbia College. The latter gentleman, in a brief prefatory note, says, "There is great need of such a popular work. It will do much good in supplying information to our people about some of the common things around them, and this in an attractive manner."

The method of using the book is as simple as can be desired. Provided with a leaf of the tree to be identified, the inquirer, by a brief inspection of the easily mastered guide, is referred to the pages containing a drawing of the leaf (and sometimes the fruit) and the name and description of the tree. Both the popular and the scientific names are given, together with some account of the uses of the tree, and its distribution. Photo-engravings of the leaves and fruit, instead of the somewhat crude outline drawings, would, we think, have been more in keeping with the excellent mechanical make-up of the book, and would have added much to its value.

The Antiquities of Tennessee. By GATES P. THRUSTON. Cincinnati, Robert Clarke, 1890.

THE present volume is an excellent *résumé* of the results of recent archæological investigations in Tennessee. It is amply illustrated by good photo-engravings and numerous sketches of well-selected specimens. Many of them do not differ essentially from the well-known types of this region; but others will be found to be of great interest; for instance, the tattooed face bowl (p. 94), and the image in clay showing an infant strapped to a cradle-board (p. 112). The descriptions of the finds are so full of new, valuable, and well-arranged matter, that they will repay a close study. The conclusions which the author draws from his studies

seem to be in the main well founded. He justly emphasizes the fact that the finds show no evidence whatever of a culture of a stamp different from that of the North American Indians, more particularly from that of the southern Indians as described by early travellers. He is also right in laying stress upon the dissemination of culture among the inhabitants of pre-Columbian America, which entails transmission not only of arts and industries, but also of manufactures. While in the introductory chapter of his book he does not consider the culture of the mound-builders as much higher than that of the Indians shortly before they came into contact with the whites, it seems, that, while studying the specimens, the culture of the mound-builders appeared to the author of increasing value; so that in his concluding chapter he is inclined to assume a decline of culture during the period following the "stone grave time." We believe that this decline may have been somewhat overestimated by the author, but we fully agree with his opinion that the mound-builders of Tennessee were Indians, and that the relics do not belong to any great antiquity. The author assumes that the decline in culture came about by an invasion from the north of a race which he believes he can recognize in a number of dolichocephalic crania taken from the stone graves. This proof must be rejected, as it is founded on the theory that a race is homogeneous, while actually, even in long-isolated races, we must expect to find a great variety of forms. Unfortunately archæologists do not yet duly appreciate the importance of osteological collections, a few well-preserved skulls being all that are deemed worthy of preservation. Broken skulls, and particularly skeletons, ought to be preserved as well, as only a thorough investigation of *all* the remains of a race will lead to reliable conclusions. Physical anthropology does not consist of a few cranial measurements, but is a detailed study in comparative osteology of man.

AMONG THE PUBLISHERS.

THE *Jenness-Miller Magazine* for November contains another article on "Physical Culture," by Miss Mabel Jenness; and "Temperance in Food," by Burcham Harding.

—Among the interesting exhibits at the American Institute Fair in this city is a handsome showcase filled with samples of the books published by E. & F. N. Spon of this city and London.

—A new edition of No. 57 of Van Nostrand's Science Series ("Incandescent Electric Lighting") has just been issued. New papers, by L. H. Latimer and C. J. Field, take the place of those by Du Moncel and Preece in the former edition, bringing the work more nearly to date.

—Vol. IV. No. 7 of the "Studies from the Biological Laboratory" of Johns Hopkins University, Baltimore, contains two articles,—one, "Notes on the Anatomy of *Sipunculus Gouldii* Pourtales," by E. A. Andrews (with plates); and the other, "The Relationships of Arthropods," by H. T. Fernald (with plates).

—The Leonard Scott Publication Company, New York, announce that beginning with the November number they will in the future furnish their subscribers with the original Edinburgh edition of *Blackwood's Magazine*, printed in Edinburgh, and published by them, here under authority of Messrs. William Blackwood & Son.

—The *Illustrated American* makes an offer in our advertising columns which may prove attractive to some of our readers. This weekly has certainly contained much interesting matter, unusually well illustrated, concerning the goings-on in the world, in which intelligent people are interested, and it is only to be regretted that in the recent numbers certain criminal affairs have been made prominent and served up in a style likely to entrap the unsuspecting reader into their perusal. The periodical is a new one, and deserves a careful examination at the hands of the reading public.

—Messrs. Houghton, Mifflin, & Co. have published a small volume entitled "Thoreau's Thoughts," consisting of brief passages selected from Thoreau's various writings by H. G. O. Blake. The selections seem to have been made with good judgment, except that they are too short. The editor has not included many of those passages descriptive of natural objects that so abound in

his author's works, but has confined himself in the main to thoughts on moral topics, such as study, society and solitude, friendship, and others of the like nature; and in this we think he has done wisely, for such ethical sayings are the most likely to do good. We cannot say, however, that we find much depth or originality in Thoreau's thinking, and we doubt if he has had much real influence even over his admirers.

—A neat and useful pocket manual for army officers is "Notes on Military Hygiene," by Lieut.-Col. Alfred A. Woodhull, which has recently been published by John Wiley & Sons. The little volume contains what may be called the essence of a series of lectures on military hygiene, delivered by the author at the Infantry and Cavalry School at Fort Leavenworth. Though originally prepared for the convenience of students, the work will no doubt prove acceptable to officers of the line generally. Among the topics discussed are the selection of soldiers, military clothing, food, habitations, camps and marches, sewers and waste, water, and preventable diseases.

—Messrs. Houghton, Mifflin, & Co. have just issued another volume (Vol. 34) of their Modern Classics,—a series which Dr. William T. Harris, United States commissioner of education, has called an "unrivalled list of excellent works." This new volume, entitled "Thackeray's Lighter Hours," contains "Dr. Birch and his Young Friends," "Selections from the Book of Snobs and the Roundabout Papers," and "The Curate's Walk." Modern Classics has a very extensive sale as a school library, for which it is well suited, as it contains many of the best complete stories, essays, sketches, and poems in modern literature, including selections from the celebrated authors of England and America, and translations of masterpieces by continental writers.

—William M. Goldthwaite, New York, has published a "Driving Road Chart of the Country surrounding New York City." This chart covers every place within twenty miles radius of the City

Hall, and in parts extends out to nearly forty. This map will be specially useful to all living in or near the city, or contemplating removing to it.

—Herbert Ward, in the preface to his "Five Years with the Congo Cannibals," tells his story of the rear-guard of the Stanley expedition for the relief of Emin Pacha. The trials of those left behind by Mr. Stanley when he pushed forward, the fate of Major Barttelot and Mr. Jameson, and Mr. Ward's own part in the transactions of that trying period, form an interesting chapter in the history of Mr. Stanley's great enterprise.

—A map of the valley of Virginia, showing the location of all the industrial towns, battle-fields, mountain-passes, and Luray caverns (10 cents), is published by Alex. Y. Lee, C.E., Luray, Va.

—Volume II. of the "Bulletin of the Illinois State Laboratory of Natural History, Champaign, Ill.," contains the following articles: "Descriptive Catalogue of the North American Hepaticæ, North of Mexico," by Lucien M. Underwood; "Description of New Illinois Fishes," by S. A. Forbes; "Parasitic Fungi of Illinois," Part I., by T. J. Burrill; "Studies on the Contagious Diseases of Insects," I., by S. A. Forbes; "List of the Described Species of Fresh Water Crustacea from America, North of Mexico," by Lucien M. Underwood; "Parasitic Fungi of Illinois," Part II., by T. J. Burrill and F. S. Earle; "Studies of the Food of Fresh-Water Fishes," by S. A. Forbes; and "On the Food Relations of Fresh-Water Fishes," by S. A. Forbes. Vol. III. of the same publication contains, among others, the following articles: "A Descriptive Catalogue of the Phalangiinæ of Illinois," by Clarence M. Weed; "A Partial Bibliography of the Phalangiinæ of North America," by Clarence M. Weed; "On an American Earthworm of the Family Phreoryctidæ," by S. A. Forbes; "An American Terrestrial Leech," by S. A. Forbes; "A Preliminary Report on the Animals of the Mississippi Bottoms near Quincy, Ill., in August, 1888," Part I., by H. Garman; and "Notes on Illinois Reptiles and Amphibians,"

Publications received at Editor's Office,
Oct. 20-Nov. 8.

- ABBOTT, C. C. Outings at Odd Times. New York, Appleton. 282 p. 16°. \$1.50.
- BALL, W. P. Are the Effects of Use and Disuse inherited? (Nature Series.) London and New York, Macmillan. 156 p. 12°. \$1.
- BELDING, L. Land Birds of the Pacific District. (Occasional Papers of the California Academy of Sciences, II.) San Francisco, Cal. Acad. Sci. 274 p. 8°. \$2.50.
- COPE, R. The Distribution of Wealth; or, The Economic Laws by which Wages and Profits are determined. Philadelphia, Lippincott. 364 p. 8°. \$2.
- DURHAM, W. Astronomy. Sun, Moon, Stars, etc. (Science in Plain Language.) Edinburgh, Black. 133 p. 12°. (New York, Macmillan, 50 cents.)
- EIGENMANN, C. H. and Rosa S. A Revision of the South American Nematognathi or Cat-Fishes. (Occasional Papers of the California Academy of Sciences, I.) San Francisco, Cal. Acad. Sci. 508 p. 8°. \$3.
- ELDERTON, W. A. Maps and Map Drawing. London and New York, Macmillan. 129 p. 24°. 35 cents.
- ELECTRIC Railway Advertiser. Vol. I. No. 2. f. Boston, Mass., G. L. Austin. 44 p. f°. \$1 per year.
- GAME Laws, Book of the. Vol. I. No. 1. New York, Forest and Stream Publ. Co. 228 p. 8°. 50 cents.
- LATIMER, L. H. Incandescent Electric Lighting. A Practical Description of the Edison System. (Van Nostrand's Science Series, No. 57.) New York, Van Nostrand. 140 p. 18°. 50 cents.
- LINDSAY, T. B., ed. The Satires of Juvenal. New York, Cincinnati, and Chicago, American Book Co. 226 p. 16°.
- MCLENNAN, E. Cosmical Evolution: A New Theory of the Mechanism of Nature. Chicago, Donohue, Henneberry, & Co. 399 p. 12°.
- MUSICK, T. H. The Genesis of Nature considered in the Light of Mr. Spencer's Philosophy, as based upon the Persistence of Energy. New York, J. B. Alden. 377 p. 12°.
- ROSA, D. Le Nov Latin International Scientific Lingua Super Natural Bases. (Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino, vol. v. No. 89.) Torino, Libreria Carlo Clausen. 10 p. 8°.
- SHEPHERD, H. A. The Antiquities of the State of Ohio. Cincinnati, Robert Clarke & Co. 139 p. 4°. \$2.

- SHUFELDT, R. W. The Myology of the Raven (*Corvus corax sinuatus*). London and New York, Macmillan. 343 p. 8°. \$4.
- TEACHERS' Manual. Public Schools of the District of Columbia. Washington, Linotype Print. 84 p. 8°.
- THOREAU'S Thoughts: Selections from the Writings of Henry David Thoreau. Ed. by H. G. O. Blake. Boston and New York, Houghton, Mifflin, & Co. 153 p. 16°. \$1.
- TUCKERMAN, A. Index to the Literature of Thermodynamics. Washington, Smithsonian Inst. 239 p. 8°.
- VELSCHOW, F. A. The Natural Law of Relation between Rainfall and Vegetable Life, and its Application to Australia. London, Edward Stanford. 40 p. 8°. 25 cents.
- WALLACE, W. Life of Arthur Schopenhauer. London, Walter Scott; New York, A. Lovell & Co. 217 p. 12°. 40 cents.
- WOODHULL, A. A. Notes on Military Hygiene, for Officers of the Line: A Syllabus of Lectures at the U. S. Infantry and Cavalry School. New York, Wiley. 150 p. 16°.

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including Several Species not before recorded from the Northern States," by H. Garman.

—The annual of the Office of Naval Intelligence (United States Navy Department), bearing date of June, 1890, has just appeared. It is No. IX. of the General Information Series, and is intended to bring to the attention of naval officers and others interested in naval matters the year's progress in naval development abroad, and to preserve a record of it in permanent form for reference. The volume exhibits the progress of foreign nations rather than that of our own; and the information conveyed in the "Notes," which occupy the most prominent place in the volume, is compiled from professional papers and journals, almost all of it having already appeared in print. Among the contents are notes on ships and torpedo-boats and on machinery, ordnance, and armor; on the application of electricity in the navy; and on the naval manœuvres of 1889. There are also papers on "The Ministries of Marine and Personnel of Several European Navies," "Administration of the Merchant Marine in Foreign Countries," "The Development of Rapid-Fire Guns for Naval Use," "The Year's Development of Home Resources for the Production of War Material," "Liquid Fuel for Torpedo-Boats," "The Manœuvring Distances of Steamers," and "Automobile Torpedoes." Twelve plates add to the value of the work.

—The *Popular Science Monthly* will make a new departure in 1891 by publishing a series of comprehensive and fully illustrated articles on "The Development of American Industries since Columbus," in which the progress of iron and steel making, of the cotton manufacture, and of the woollen, glass, leather, and other leading industries, will be described by writers of long practical

acquaintance with their respective subjects. It has been announced that one of the features of the coming world's fair is to be a comparison of the great manufactures of to-day with the condition of the same industries at the discovery of America, and it is the design of these papers to describe the successive steps by which the distance between those two stages has been passed over. The series begins in the issue for December, 1890 (the second number of Volume XXXVIII.), with an account of the first steps in iron-making in the Colonies, written by Mr. W. F. Durfee of Pennsylvania. The full prospectus of the *Monthly* for the coming year will be printed in the same number. Hon. David A. Wells will also begin during the coming year a series of papers on "The Principles of Taxation;" Dr. Andrew D. White's "New Chapters in the Warfare of Science" will be continued; and other articles bearing upon the advances of science, and upon questions of the day, are promised. What shall we do with the "Dago"?—a puzzling question that seems likely to take rank with the Chinese problem—will be discussed by Mr. Appleton Morgan in the December number. Among the greatest achievements of science are the discoveries that sound, heat, and light are vibratory movements, each in its proper medium. The nature of electricity, however, has long remained unknown; but at last Dr. Henri Hertz of Heidelberg has reached a result that has been widely accepted by the most eminent physicists. A translation of his own account of his discoveries, under the title "The Identity of Light and Electricity," will be printed in the same number. The bore of the Amazon will also be described by Mr. John C. Branner, State geologist of Arkansas. The "bore," which is one of the most impressive phenomena of nature, occurs only in narrow estuaries where high tides prevail.

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